Air Quality

EPA Region 2 has long recognized the threat that air pollution poses to human health and the environment, especially in the urban areas of New York, New Jersey and Puerto Rico. A 1990 comparative risk study conducted by the Region showed that all of the Region's human health risks marked as "very high" were related to air pollution. Air quality in Region 2, as in most industrialized areas, is impacted by emissions from automobiles, manufacturing, utility plants, refineries, and other mobile and stationary sources of pollution. Although significant improvements in air quality have been made over the last several decades, additional challenges remain.

Jenine Tankoos

Air is Cleaner and Safer to Breathe

The Clean Air Act (originally passed in 1970 and significantly amended in 1977 and 1990) addresses two major categories of air pollutants. The law required EPA to establish national standards for six common (or criteria) air pollutants: lead, nitrogen dioxide, sulfur dioxide, carbon monoxide (CO), particulate matter, commonly called soot, and ground-level ozone, known to many as smog (Figure 1). Standards were established to protect human health, especially in sensitive populations including children, the elderly, and asthmatics, and to reduce air pollution impacts on agriculture, the environment and visibility. It also initiated a process to regulate toxic air pollutants, the health impacts of which are less well defined but generally recognized as harmful.

Reduced Emissions of Common Pollutants

Since 1985, emissions of the common air pollutants have decreased by 28 percent throughout the Region. The most significant decrease has been in lead emissions, due to the virtual elimination of lead pollution from automobile exhaust. Reductions in common pollutants are even more impressive considering they have occurred during a period of significant increases in population, economic growth, and vehicle miles traveled (Figure 2).

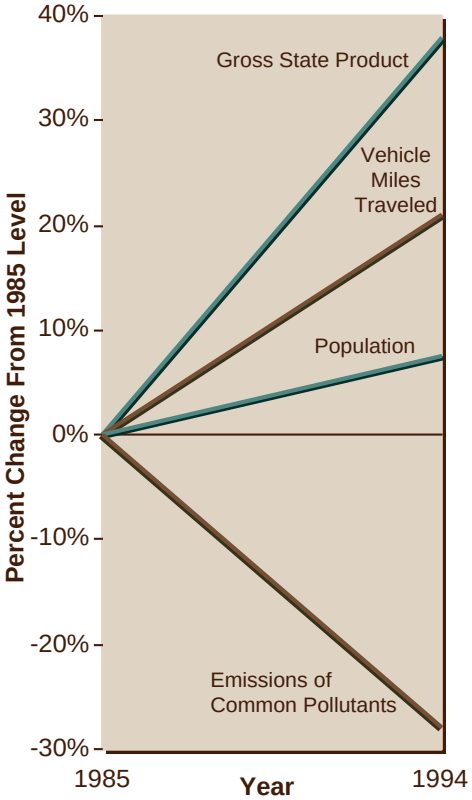
Health Effects of Common Air Pollutants

Pollutant	Change in Emissions, 1985-1994	Potential Health Effects
Ozone	-15%	Reduced lung function. Asthma, eye irritation, nasal congestion, lowered resistance to infection.
Particulate Matter	-29%	Eye and throat irritation, bronchitis, lung damage, and premature death.
Carbon Monoxide	-25%	Ability of blood to carry oxygen impaired. Cardiovascular, pulmonary and nervous systems affected.
Sulfur Dioxide	-25%	Respiratory tract problems; permanent lung damage.
Lead	-80%	Developmental impairment, especially in children.

Source: National Air Pollutants Emissions Trends, 1900-1994.

Figure 1

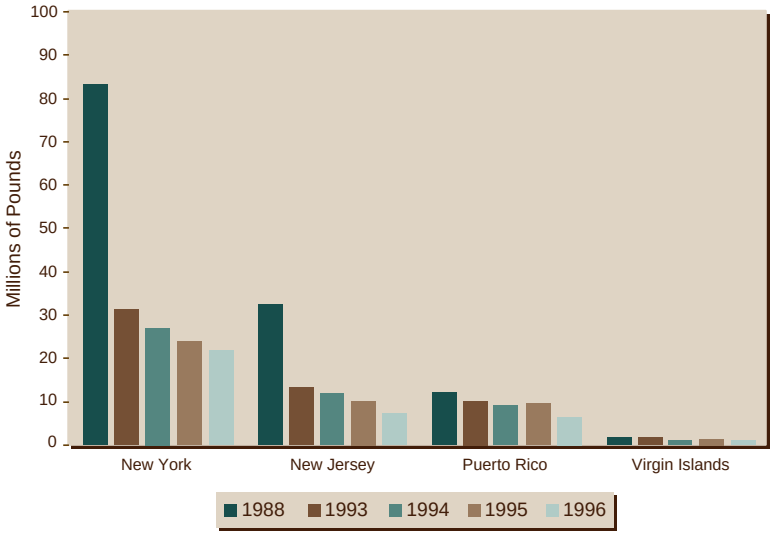
Emissions Decrease as the Population and Economy Grow



Source: Population and VMT data from U.S. Census; emissions data from National Air Pollutants Emissions Trends, 1990-1994; GSP data from Bureau of Economic Analysis.

Figure 2

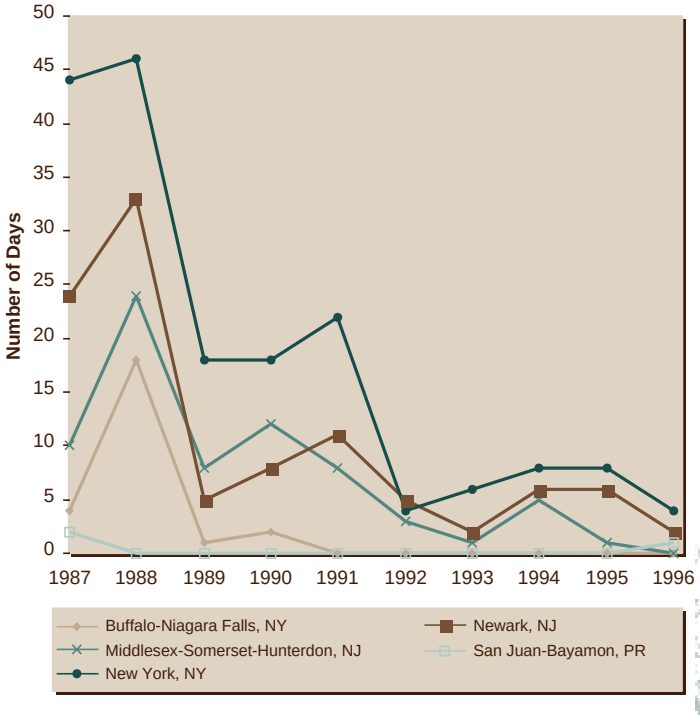
Releases of Toxic Chemicals to the Air Decline Significantly



Source: U.S. Toxics Release Inventory.

Figure 3

Unhealthy Air Days are Decreasing



Source: National Air Quality and Emissions Trends Reporting 1996.

Figure 4

Reduced Toxic Emissions

Exposure to airborne toxic compounds such as benzene and mercury can contribute to health problems including cancer and respiratory illness. EPA sets emissions standards for individual compounds, placing a priority on the most common and harmful chemicals. One measure of air toxic emissions to the atmosphere is the Agency's Toxics Release Inventory (TRI), an annual register of more than 600 toxic chemicals released into the environment. TRI emissions data are estimates provided by industry. The facilities that submit reports, as well as the actual chemicals reported, can change from year to year. Even accounting for these data limitations, total emissions of airborne toxic chemicals decreased significantly between 1988 and 1996 (Figure 3).

Fewer Unhealthy Air Days

Reductions in the number of unhealthy air days demonstrate improvements in the Region's overall air quality. To determine whether air is unhealthy, EPA measures the air quality in urban areas using the Pollution Standard Index, or PSI. The PSI converts the concentration of each criteria pollutant in the air to a number on a scale of 0 to 500, with a score greater than 100 indicating unhealthful air. Since 1987, the number of days with PSI values exceeding 100 has decreased (Figure 4).

Addressing the Challenges

Despite Regional and national improvements in air quality, the citizens of Region 2 still face significant outdoor and indoor air quality problems.

Meeting Air Quality Standards

The states in Region 2 measure the concentrations of air pollutants in the air (ambient conditions) and compare them to the federal health-based standards. The Agency designates geographic areas that fail to meet the standards for common pollutants as "non-attainment areas." While most of Region 2 meets air quality standards for most pollutants, the Region's more densely populated areas exceed the standards for carbon monoxide, ozone and particulate matter.

Carbon Monoxide (CO)

Due primarily to mobile sources of emissions—cars, trucks and buses—New York City, Westchester and

Nassau counties in New York State, and the northeastern portion of New Jersey are designated CO non-attainment areas. Mobile sources contribute as much as 66 percent of CO in the air. CO exhaust from vehicles poses a significant problem in cities like New York, with high levels of traffic congestion and where the pollution is trapped between tall buildings. There has already been a major drop in the number of days that measured CO levels exceed health standards. The number has declined from over 300 days in 1971 to more than 100 in 1985, to zero in 1996. Within two years, New Jersey and New York will implement enhanced vehicle inspection and maintenance programs that ensure federal health standards for CO are met everywhere.

Jenine Tankoos

Ground-level Ozone

By far the worst air quality problem in Region 2, ground-level ozone, the major component of smog, forms when nitrogen oxides and volatile organic compounds (VOCs) chemically react in warm temperatures and sunlight. Typical sources of smog-forming pollutants include industrial facilities, automobiles, and even consumer products such as hair spray and charcoal lighter fluid. Ground level ozone, not to be confused with stratospheric ozone, which protects us from ultraviolet radiation, is a serious health threat that can exacerbate the symptoms of asthma, damage lung cells, and reduce the lung's ability to fight infection. In addition, it can cause significant environmental damage, reducing the resistance of plants to disease, pests, and other stresses. Ozone has clear, documented impacts on human health, crops, and ecosystems.

EPA recently revised its health-based standard for ozone. The previous standard was 0.12 parts per million (ppm) measured over a one hour period.

Since that time, the results of over 3,000 new studies on ozone have shown that it can cause adverse health effects at levels below the old standard. For this reason, EPA adopted a more stringent standard of 0.08 ppm over an eight hour period to better protect public health. By averaging over eight hours, the standard helps protect people who spend a significant amount of time working or playing outdoors—particularly children, a group that is especially vulnerable to the effects of ozone.

Curbing Acid Rain

Acid rain is formed when sulfur dioxide (SO_x) and nitrogen oxides (NO_x) — pollutants resulting primarily from burning coal, oil, and other fossil fuels — mix with water vapor in the atmosphere to create acidic compounds. Once formed, these compounds may travel hundreds of miles before falling on the earth in rain, fog, snow or dust. Acid rain impacts aquatic ecosystems and high altitude forests, creates haze, and contributes to the deterioration of automobile paint, buildings, and historical monuments. The pollutants that cause acid rain can also exacerbate asthma and other lung disorders.

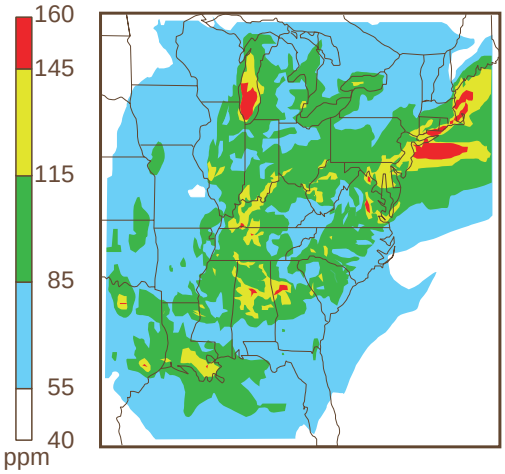
S.C. Delaney/EPA

Most acid rain in New York and New Jersey is from power plants located in the Midwest. According to the Adirondack Lakes Survey Corporation, a branch of the New York State Department of Environmental Conservation, the effects of acid rain have left more than three hundred lakes and ponds in the Adirondack Mountains without fish. Another three to four hundred may be so acidic that populations of sensitive fish species have been eliminated or severely reduced.

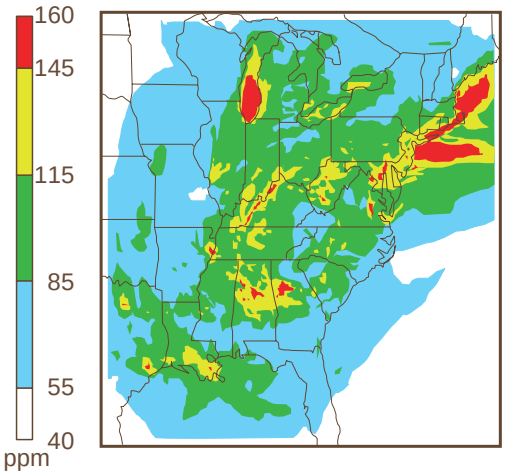
To curb the production of acid rain, EPA utilizes an innovative market-based approach to control sulfur dioxide emissions at electric utility power plants. Once EPA establishes emissions limits, utilities are given the flexibility to decide how best to meet them. Options include the "trading" of sulfur dioxide emissions and emissions reductions. This program demonstrates that private markets can be used to meet overall environmental quality goals. It has already resulted in significant sulfur dioxide emission reductions nationwide, at savings of approximately $3 billion per year over traditional approaches. EPA has also established a nitrogen oxides emission-reduction program. Although not a market-based approach, utilities are given flexibility in complying with the requisite emission reductions. In addition to these emissions reduction strategies, the new federal standards for ozone and particulate matter will likely result in decreased emissions of nitrogen and sulfur dioxide from the Midwest.

Expected Impact of OTAG on Future Ozone Conditions

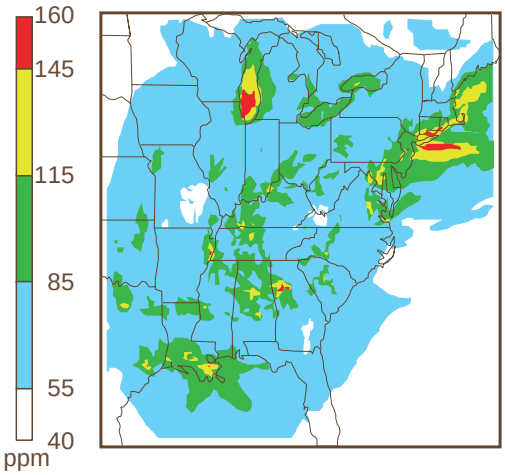
Ozone Episode 1997



Effects of Clean Air Act in 2007



Effects of OTAG in 2007



Source: OTAG Northeast Modeling and Analysis Center.

Figure 5

The information in this report focuses on the progress addressing the old one-hour ozone standard, since more air quality information needs to be collected and analyzed before trends for the eight-hour ozone levels are available. However, programs designed to achieve compliance with the one-hour ozone standard will also reduce eight-hour ozone levels.

In Region 2, measurements of ozone in the urban corridor stretching from the Philadelphia-Camden area through the New York City metropolitan area exceed both the old one-hour standard and the new eight-hour ozone standard. Attainment of the new standard is expected to require more reductions in emissions than the existing ozone standard, so areas will be given additional time to comply.

Despite air quality improvements, many eastern states have had difficulty meeting the one-hour ozone standards. This led to the formation of the Ozone Transport Assessment Group (OTAG), which included representatives from 37 participating eastern states. OTAG was charged with assessing the significance of ozone transport and with recommending strategies for reducing ozone formation and transport. In 1997, after two years of information gathering and debate, the group submitted its recommendations for meeting ambient air quality standards to EPA. The recommendations include steps to reduce emissions of compounds that lead to ozone production. In addition, OTAG recommended implementing an innovative emissions trading program that would give states greater flexibility in meeting air quality standards and significantly reduce the costs of emissions reductions.

The maps at left illustrate projected improvements from implementing the OTAG recommendations. The first map shows the highest one-hour concentrations of ozone associated with a bad smog episode in 1997. The second map illustrates the likely effect of implementing the emission reduction programs called for in the Clean Air Act. As the map shows, improvements are limited, due to the expected growth in sources of pollution, and continued increases in vehicle miles traveled and the demand for electrical power. If, however, all the OTAG strategies are fully implemented, as illustrated in map three, a 20 to 40 percent ozone reduction is expected in the northeast corridor by the year 2007 (Figure 5).

Particulate Matter (PM)

Particulate matter is a mixture of solid and liquid particles, varying greatly in size and in chemical and physical properties. Sources include vehicles, incinerators, power plants, and dust from farms and construction sites. PM can cause respiratory illness and other health problems. In Region 2, the New York City borough of Manhattan and Guaynabo, Puerto Rico are both classified as non-attainment areas for PM. This is largely due to mobile sources such as cars, diesel trucks, and buses. EPA regulates particles that are 10 microns or less in size (about 1/7 the width of a human hair). Since the standards were revised in 1987, many important new studies have been published that show

that breathing particulate matter at concentrations allowed by the PM standard for 10 micron particles can cause significant health effects—including premature death and an increase in respiratory illness. Also, EPA believes that the standard does not adequately protect visibility (our ability to clearly perceive distance, color, contrast, and detail) in the atmosphere.

A review of the scientific data indicates that it is the smaller (or fine) particles—less than 2.5 microns in diameter—that are largely responsible for the health effects of greatest concern and for visibility impairment. Based on this information, EPA has added new particulate standards that provide for both new annual and 24-hour standards, while retaining the existing standard. EPA estimates that the new standards, along with clean air programs already planned, will reduce premature deaths by about 15,000 a year and serious respiratory problems in children by about 250,000 cases a year.

Tackling Indoor Air

Concentrations of certain pollutants, including lead, radon gas, second-hand tobacco smoke, asbestos, and pesticides, can be much greater indoors than outdoors. EPA recognizes that the indoor environment—in schools, homes, and in the workplace—often poses significant environmental health risks.

EPA's approach to indoor pollution focuses on educating the public about indoor air health threats and ways to reduce them. The Indoor Air Quality Tools for Schools program is one example of its outreach efforts. Schools often face a myriad of indoor air quality problems, but have few resources to combat them. The program provides schools with an action kit to help them achieve and maintain good indoor air quality at little or no cost, using common-sense activities and in-house staff.

Reducing Radon

Radon—a colorless, odorless, naturally occurring radioactive gas formed from decaying radium and uranium in soil—is the nation's second leading cause of lung cancer, resulting in an estimated 7,000 to 30,000 cancer deaths per year nationwide. Radon gas migrates through the soil, most frequently entering buildings through cracks in foundations.

Taking Steps to Identify and Prevent Asthma

Asthma is the leading cause of chronic illness and sickness-related school absenteeism in children. Throughout the Region—from New York City to the Caribbean—citizens are at risk from indoor and outdoor sources of pollution that contribute to asthma. While research is still needed to determine what causes asthma, we do know that various factors can trigger asthma attacks, including tobacco smoke; allergens such as cockroaches, dust mites, pollen, and molds; particulate matter and ozone. Unfortunately, linking a specific pollution source to observed asthma cases is extremely challenging.

EPA and its state and local partners have studied the incidence of asthma in a number of areas to characterize threats and develop programs to respond to them. In Puerto Rico, EPA examined the prevalence of respiratory problems among school-aged children living in the Cataño Air Basin and collected data on air pollutants in the area. The study found an extremely high incidence of asthma among children living in the area. However, the study did not verify that air quality conditions unique to the Cataño urban environment were contributing to the asthma. EPA continues to carefully monitor outdoor conditions and is investigating other factors. The Agency is supporting the University of Ponce Medical School's efforts to collect information about indoor allergens and irritants that may be specific to this tropical environment. In addition, EPA is supporting the Puerto Rico Department of Health by providing resources for an asthma coordinator to assist in these efforts.

New York City's South Bronx and East Harlem neighborhoods have been shown to have the highest asthma rates in the nation. In both these areas, EPA is working with community groups and scientific experts to collect information on the problem and find the most effective intervention techniques. To further investigate the issues of outdoor air pollution throughout the city, the Agency for Toxic Substances and Disease Registry is supporting an $800,000 grant to the New York State Department of Health to examine asthma and outdoor air pollution in the South Bronx and in Upper Manhattan. To address the issue of exposures to pollution indoors, EPA has provided nearly $1 million in grant funds, divided among research, education, and intervention programs.

S.C. Delaney/EPA

Fortunately, radon problems are usually easy and inexpensive to find and address. Effective radon detectors are readily available, and homeowners who detect a problem can follow EPA's simple mitigation strategies to divert the gas outside where it is not dangerous. Throughout the Region, an estimated 900 lung cancer deaths have been averted as a result of more than 20,000 residential radon mitigations.

EPA actively supports an education effort that promotes residential radon testing, and provides assistance in mitigating radon problems. Throughout New York and New Jersey, the number of households conducting radon tests has increased tremendously over the past six years. Approximately 60,000 radon tests and 3,000 mitigations were performed in Region 2 in 1996 alone. In New Jersey's highest radon risk areas, strengthened building codes require new homes to be radon-resistant. As a result, over 23,000 radon-resistant homes have been built.

Lowering Lead Levels

Lead poisoning is a major environmental health hazard for young children, affecting as many as one million children age five and under, according to the National Centers for Disease Control and Prevention. Adults exposed to high levels of lead, usually in the workplace, are also at risk. Even at low levels, lead poisoning in children can cause IQ deficiencies, reading and learning disabilities, impaired hearing, reduced attention spans, hyperactivity and other behavior problems. A pregnant woman poisoned by lead can transfer the metal to her developing fetus, causing development effects. Chronic exposure can damage the kidneys and nervous system and cause high blood pressure.

The EPA ban of lead in gasoline twenty years ago has resulted in a 98 percent reduction in lead levels in the air, protecting millions of children from serious, permanent learning disabilities by helping to reduce blood lead levels by 75 percent. But children are still at risk from eating chipping or peeling lead paint and exposure to lead-contaminated dust that accumulates on window sills and floors.

Successful EPA and state lead education and intervention programs have also helped to reduce the number of lead-poisoned children. In 1996, 2600 children, or 0.6 percent of the total screened for lead exposure through a New York State lead program, were diagnosed with lead poisoning (blood lead levels greater than 20 ug/dl). This is a significant decline from the 4,237 children, or 1 percent of those screened, found to have lead poisoning in 1994.

Things You Can Do

- Maintain your car properly and drive at 55 mph. For every mile-per-hour over 55, the average car or truck loses almost 2 percent in gas mileage.
- Give your car a day off — consider transportation alternatives such as mass transit, carpooling, bicycling, and telecommuting.
- Inquire about and, when appropriate, remediate lead hazards. When buying or renting a home or apartment built before 1978, the seller or landlord is now required to disclose known lead hazards.
- Plant trees — they absorb carbon dioxide (a global warming gas) from the air.
- Test your home for radon.
- Encourage your school to implement an Indoor Air Quality Tools for Schools program to improve indoor air.

For More Information

National Radon Hotline: 800-767-7236

Indoor Air Information Clearinghouse

Internet Homepage: http://www.epa.gov/iaq/iaqinfo.html

Phone: 800-438-4318

EPA Office of Air and Radiation

Internet Homepage: http://www.epa.gov/oar/oarhome.html